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Small Mammal Utilization of Vernal Pools San Diego County, California

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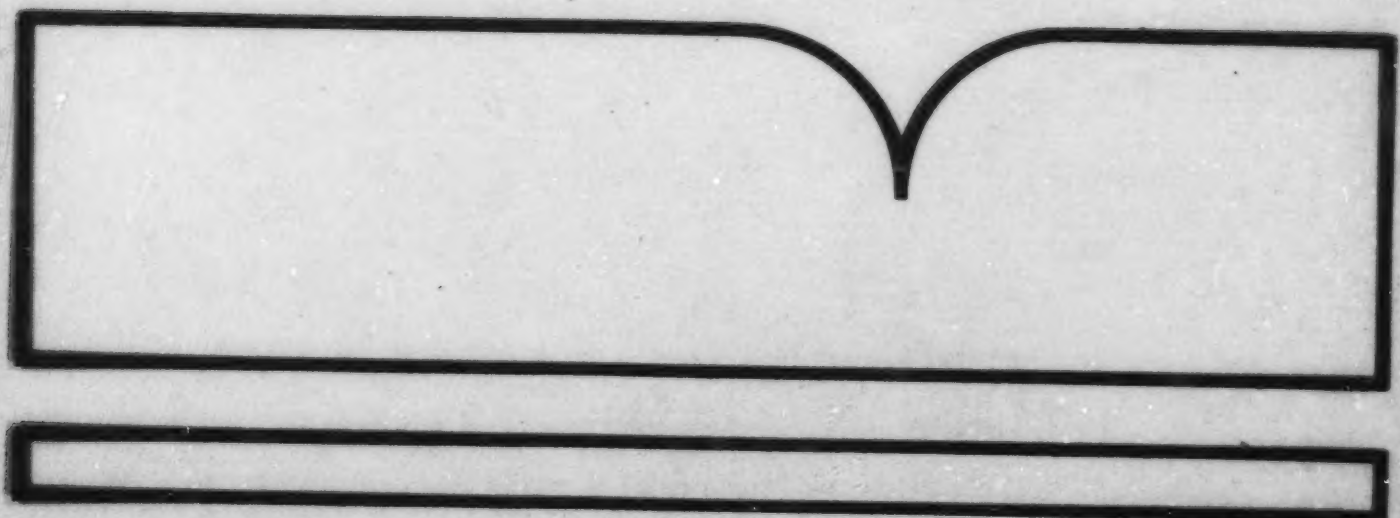

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16. ABSTRACT

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SMALL MAMMAL UTILIZATION OF VERNAL POOLS, SAN DIEGO COUNTY, CALIFORNIA

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Abstract. This study investigated use of a large vernal pool on local small mammal populations. The vernal pool provides a potential source of food (insects, vegetation) for small mammals and, when dry, possible habitat for residence. Seven species of mammals were captured during the study: Peromyscus maniculatus, Dipodomys agilis, Reithrodontomys megalotis, Microtus californicus, Perognathus fallax, Sylvilagus audubonî, and Neotoma fuscipes. Only three of these species were trapped in the dried up vernal pool per se: Reithrodontomys, Peromyscus, and Microtus. Only Reithrodontomys had a higher estimated population at the pool than was found at the non-pool control site. Reithrodontomys reportedly will include insects as a large portion of their diet, thus their abundance at the pool site may reflect the greater availability of insects (larvae and adults) as a food source. There was no evidence of small mammal burrowing or nesting activity in the dried vernal pool bottom.

INTRODUCTION

Vernal pools are temporary ponds that develop in shallow depressions as the result of seasonal precipitation during the late winter and spring. A unique flora has evolved in California vernal pools (Holland and Jain 1977). Due to the protracted existence of moisture the pool flora remains green longer than the surrounding herbaceous vegetation and sets seeds later in the season. As the pools dry up their vegetation provides a potential food source for surrounding small mammal populations. After the pools are completely dry, they also provide additional potential small mammal habitat.

The objective of this study was to discern if the presence of vernal pools in chaparral and coastal sage scrub communities in south San Diego County, California has a measurable effect upon the distribution of local populations of small mammals. The study addressed the following questions:

1. Are there measurable differences in the species composition, relative abundance and density of small mammal populations between vernal pool and non-pool areas?
2. Does the presence of vernal pools result in the occurrence of species that would not otherwise occur?
3. In what ways do small mammals utilize vernal pools?

This study was part of a larger project that investigated the roles and function of small isolated wetlands and intermittent streams, nationwide. Federal funding was provided by the U.S. Environmental Protection Agency, Contract No. 68-03-2901; Dr. Keith B. Macdonald, Woodward-Clyde Consultants, Principal Investigator.

STUDY AREA

The study site is located in south San Diego County, California adjacent to the southeast shoreline of Lower Otay Reservoir (Figure 1). Both chaparral and coastal sage

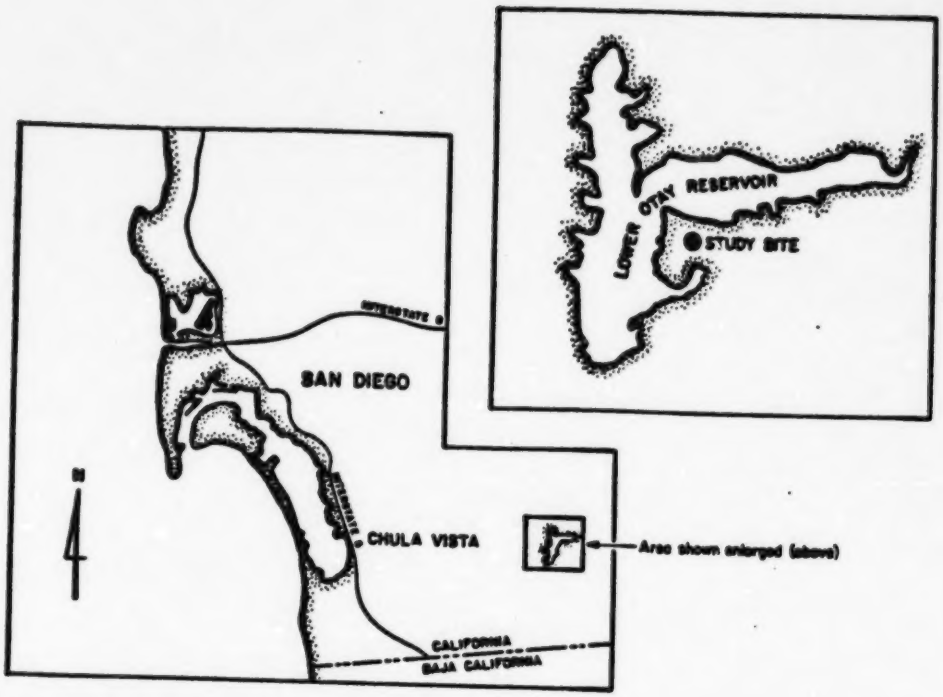

Figure 1. General location of study site.

scrub plant communities are present in the study area. California buckwheat (Eriogonum fasciculatum) is the dominant shrub species in the coastal sage scrub. Munz sage (Salvia munzii) and bladderpod (Isomeris arborea) are the common subdominant shrubs. In the chaparral, chamise (Adenostoma fasciculatum) is the dominant shrub species. The coastal sage scrub is more open than the chaparral as indicated by total shrub cover (7.7 vs 53.3 percent). Both types of plant communities are present in the vernal pool trapping grid (Figure 2).

METHODS

Small mammal population parameters (species composition and estimated numbers of individuals) were determined using a mark-recapture technique (Eisenberg 1972) in three separate sampling grids. The main grid was situated in an area that contained a large vernal pool (0.91 hectares). The sampling array in the vernal pool area consisted of 100 traps set in ten rows of ten traps, each 15 meters apart. This array covered an area of 2.8 hectares. A dense-line of 52 traps was set up around the main grid to measure emigration and immigration of individuals. This trap layout (Figure 2) is modified from the design developed by Jorgensen et al. (1971). The remaining two trap grids consisted of 25 traps each, set in a five by five/trap layout. Spacing between traps was again 15 meters. These grids each covered 0.81 hectares. One grid was set out in the pure chamise chaparral and the other in an open area dominated by California buckwheat.

All traps were modified Smith live traps. They were baited with rolled oats for five consecutive nights during each trapping period and checked the following morning. The

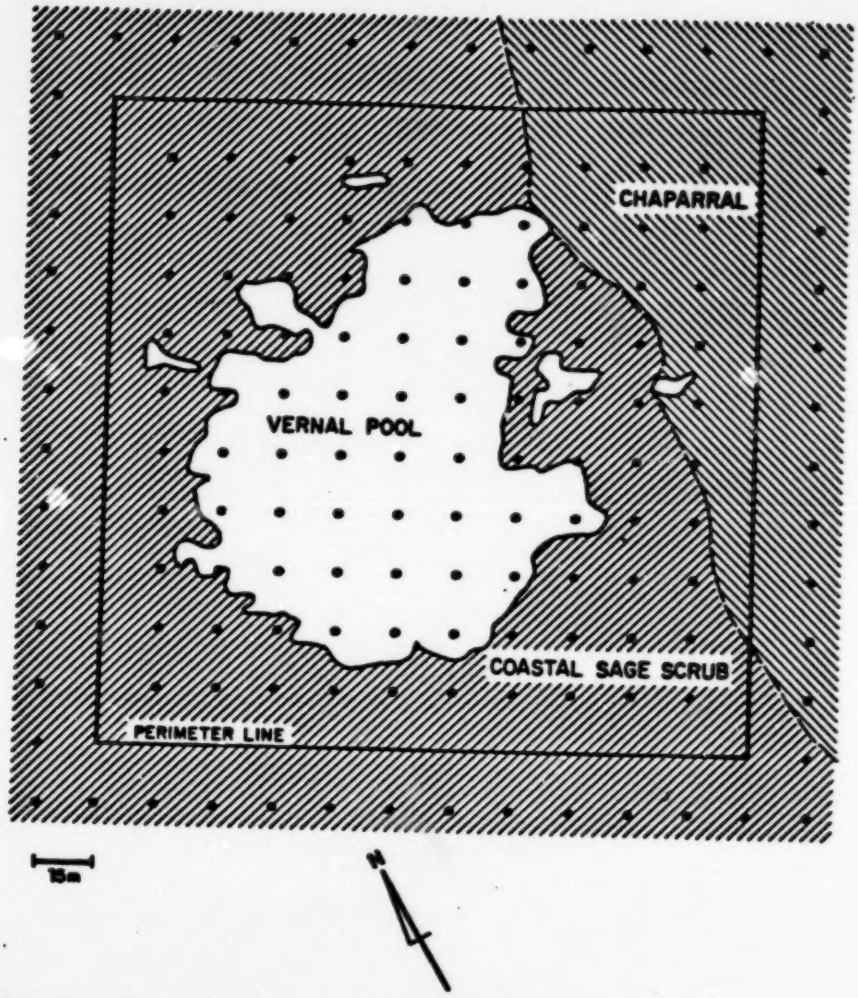

Figure 2. Vernal pool small mammal live trap sampling grid.

trapping days were as follows: March 13-17 (vernal pool full); Spring 22-26; May 20-24 (vernal pool dry); June 24-28; August 5-9; and October 21-25.

Jorgensen et al's (1975) EM-2 estimator was used to estimate population sizes for each species captured during each sampling period. In order to compare the small mammal populations within each grid the data from each grid was normalized to a per hectare unit.

RESULTS

Seven species of mammals were captured and identified during the study:

Peromyscus maniculatus	Deer Mouse
Reithrodontomys megalotis	Western harvest mouse
Neotoma fuscipes	Dusky-footed wood rat
Perognathus fallax	San Diego pocket mouse
Dipodomys agilis	Pacific kangaroo rat
Microtus californicus	California meadow mouse
Sylvilagus auduboni	Audobon cottontail

All the species observed are common to chaparral and coastal sage scrub areas in southern California (McCloskey 1972, Meserve 1976). Only two individuals of Perognathus fallax were captured during the study and this species will not be discussed any further. Few (N = 16) individuals of any species were captured at the trapping grid set in the California buckwheat, therefore, the remaining discussion is concerned with the differences in species composition and occurrence between the chaparral and vernal pool sampling grids. The lack of meaningful methods for calculation of confidence limits on small mammal population estimators (Jorgensen et al. 1975) makes it difficult to investigate the statistical significance of observed differences in estimates. Therefore, the significance of the observed trend remains unknown.

There appears to be a definite difference in the abundance of small mammal populations between the vernal pool grid and the chaparral grid. Reithrodontomys was the only species that showed a possible positive response to the vernal pool (Figure 3). This species showed the greatest occurrence of any species in the vernal pool per se, being trapped there 13 times. However, only on one occasion was an individual trapped more than once within the pool area. Although its principal food reportedly includes flowers, seeds and foliage of Eriogonum faciculatum, Reithrodontomys will include a large proportion of insects in its normal diet (Meserve 1976). The increased use of the vernal pool may be due to the increased insect population observed in association with the vernal pool. This is supported by the observation that the apparent population peak occurred in May when the number of visible insects appeared to be the greatest.

Peromyscus and Dipodomys populations from the vernal pool grid were generally lower than those from the chaparral grid (Figure 3). Both grids showed similar seasonal patterns, with population numbers reaching a peak during the summer (Figure 3). Peromyscus was trapped eight times in the vernal pool itself and most of these captures occurred in May (2) and August (4). However, these occurrences were sporadic and only on two occasions did the same animal occur more than once. Dipodomys was not captured in the vernal pool and preferred chaparral areas.

The most obvious seasonal trend of the species captured during the study was exhibited by Microtus (Figure 3). On both the vernal pool and chaparral grids, Microtus showed an increase in early summer (June) followed by a dramatic decrease by the end of summer (August). On the vernal pool grid, Microtus was usually found in the vicinity of the vernal pool proper, associated with the open grass areas with scattered shrubs. Only three individuals were captured within the defined limits of the vernal pool itself.

Sylvilagus was observed only during August on the vernal pool grid and during August and October on the chaparral grid (Figure 3). The recorded occurrence of Sylvilagus in the vernal pool study area was an artifact of sampling as individuals were observed in the area during each sampling period. However, they were not observed in the vernal pool per se and they were only trapped in the chaparral portion of the vernal pool grid. Neotoma was not observed on the vernal pool grid. On the chaparral grid, Neotoma was first observed in May. The estimated population peak occurred in June (Figure 3).

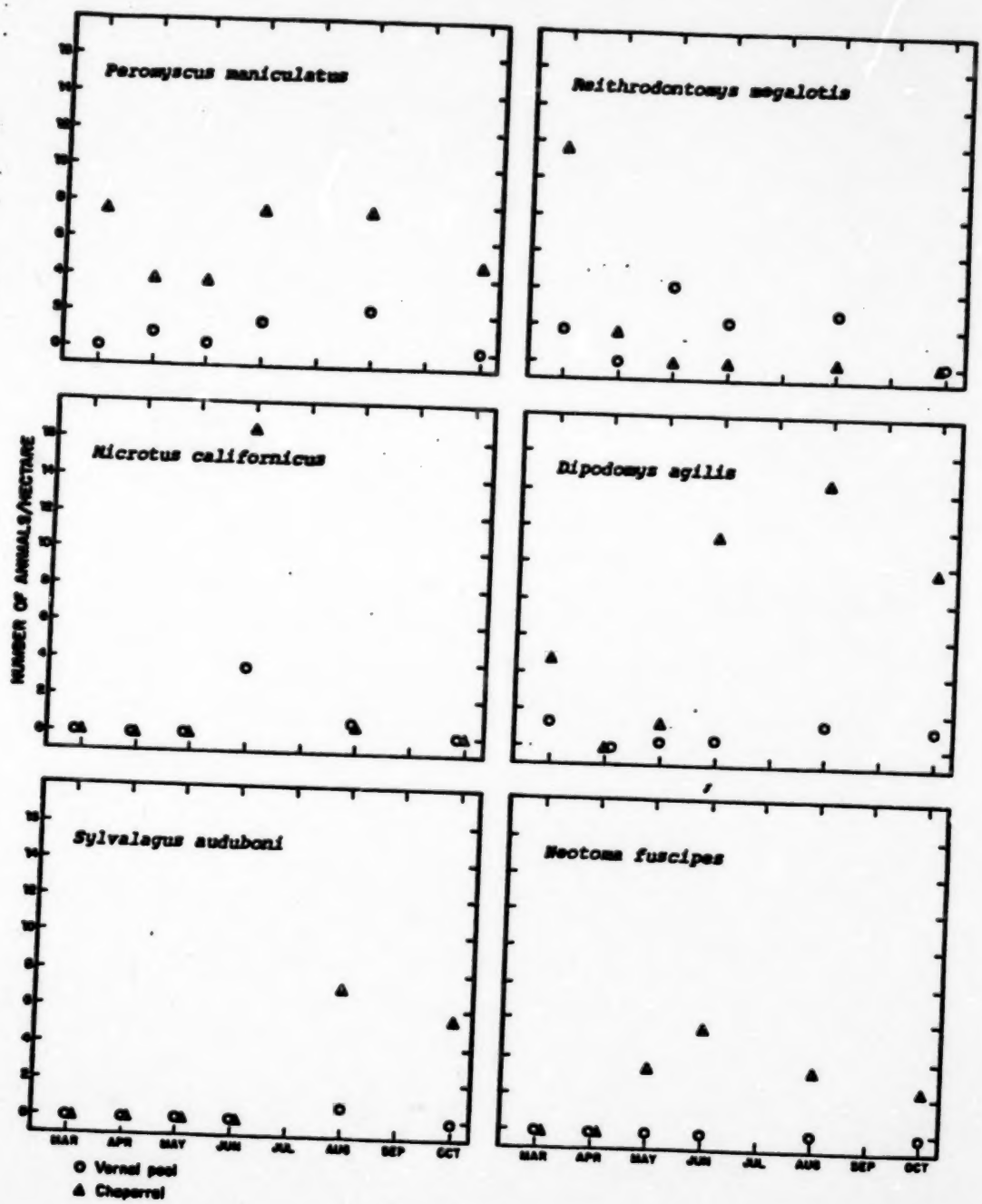

Figure 3. Population estimates (animals/hectares) for small mammal species captured from the vernal pool (O) and chapparal (▲) sampling grids.

DISCUSSION

The vernal pool did not appear to be heavily utilized by resident small mammals, even though the pool area represents a potential source of food and when dry, a possible residence area for small mammals. When the pool contained standing water, there was a large population of insect larvae and an abundance of vegetation. As the pool dried, the

vegetation became available to the surrounding small mammal populations. The more common species observed, on the vernal pool study grid -- Reithrodontomys, Peromyscus, Dipodomys and Microtus -- feed upon various plant parts including stems, flowers, etc. (Meserve 1976). In addition, ground dwelling insects will be eaten by Reithrodontomys, and to a lesser degree by Peromyscus (Meserve 1976). The only positive result which suggests that pool resources might lead to some increase in small mammal populations was with Reithrodontomys. The increase in the estimated population of Reithrodontomys may be a reflection of increased ground dwelling insect population in the vicinity of the vernal pool. However, due to the difficulty in assessing 'significant' differences between estimated population numbers of small mammals, this explanation represents a hypothesis still to be tested.

The utilization of plant food resources of the vernal pool was not investigated. The low occurrence of multiple captures within the pool area suggests that either the open pool area did not represent a particularly favorable resource or that other factors (i.e., predation pressure in open space) were more important. The winter of 1979-1980 was very wet for San Diego. As a result the shrub and herbaceous vegetation was very productive. This may have resulted in an abundance of food resources preferred by the more common mammals thus resulting in reduced dependence upon vernal pool vegetation. Reithrodontomys reportedly feeds on the flowers, seeds, and foliage of Eriogonum fasciculatum during dry months, and on Artemisia californica and Lotus scoparious during early spring months (Meserve 1976). Peromyscus has similar spring feeding habits but switches to Salvia apiana and Rhus integrifolia in late spring and early summer (Meserve 1976).

The lack of protective plant cover may have also been a deterrent to the utilization of the open pool area. This may have been especially true to Dipodomys which was only found in the chaparral areas. A marsh hawk was observed during each trip to the vernal pool and owls frequent the area.

Nesting or burrowing activity was not observed within the boundaries of the vernal pool. Dipodomys, a common burrower, was not observed in the pool areas; it's occurrences were restricted to the chaparral area. The remaining small mammals observed either build above-ground nests or shallow burrows. Possibly the 'hard pan' underlying the vernal pool precluded burrowing activities by these small mammal species.

CONCLUSIONS

This study was designed to identify the response of small mammal populations to the presence of a large vernal pool.

(1) The data suggest that there is a definite difference in the species composition and abundance of small mammal populations between vernal pool and chapparal areas.

(2) The species found in the vernal pool area have been reported in other studies of chaparral/coastal sage scrub areas in southern California (McCloskey 1972; Meserve 1976). The presence of vernal pools does not therefore result in the occurrence of species not otherwise expected.

(3) The data indicated that the vernal pool was not heavily utilized by small mammals. Comparison of trapping records from traps placed in the pool with those outside the pool suggests that the occurrence of small mammals in the dried up pool area occurred during foraging activities or dispersal from the chaparral area. No nesting or burrowing activity was observed during the survey period. The presence of insects (adults and larvae) in the vicinity of the vernal pool may be partly responsible for the increased estimated population of Reithrodontomys.

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